REMARKS

Claims 1, 9, 15 and 17-22 are in this application and are presented for consideration. By this Amendment, Applicant has amended claims 1, 9 and 15. Applicant has also added new dependent claims 17-22 to further clarify the features of the invention. Claim 16 has been canceled.

Claims 15 and 16 have been rejected under 35 U.S.C. 102(b) as being anticipated by Hsieh et al. (US 6,795,274).

The present invention relates to a scribing device and a method to form a blind crack, wherein the shape of the blind crack is determined. Light from a light source is applied to a polarization beam splitter. The polarization beam splitter splits the light emitted from the light source and transmits the light to an optical fiber. The split light is propagated through the optical fiber to the blind crack region in the brittle material substrate. The light propagated from the optical fiber is reflected by the blind crack region of the brittle material substrate and the reflected light is received by the optical fiber. The reflected light from the blind crack region is received by a light reception element via the polarization beam splitter and is detected by the determination unit. A shape state of the blind crack is determined based on an output from the determination unit. This advantageously provides a determination of whether the blind crack has been properly formed so that the glass substrate can be properly broken. This advantageously increases manufacturing and product efficiency of flat panel displays since the brittle substrate materials are broken properly as a result of checking whether the blind crack has been properly formed.

Hsieh et al. discloses a method for manufacturing a substrate for a magnetic disk via scribing. A workpiece 22 is mounted between an upper rotating spindle 26u and a lower rotating spindle 26l. The workpiece 22 is rotated and is scribed to form first and second scribe lines 38, 40 on the top surface 22a of the workpiece 22 and first and second scribe lines 42, 44 on the bottom surface 22b of the workpiece 22. The workpiece 22 is then broken along the first and second scribe lines 38, 40, 42, 44. Scribe lines 38 and 40 define the inner and outer diameters of the substrate being formed. Scribe lines 42 and 44 also define the inner and outer diameters of the substrate being formed.

Hsieh et al. fails to teach and fails to suggest the combination of a scribing device that includes a reception element, a polarization beam splitter and a determination unit for checking the formation state of a blind crack in a brittle substrate material. Hsieh et al. merely discloses forming scribe lines on a top surface and a bottom surface of a workpiece to break the workpiece along the scribed lines. Hsieh et al. is void of any suggestion of a determination unit that determines whether an amount of light received by the light reception element is within predetermined thresholds. In contrast to Hsieh et al., the determination unit of the present invention determines whether an amount of light received by the light reception element is within acceptable threshold limits. This advantageously allows the formation state of the blind crack to be checked so that it can be determined whether the brittle substrate material can be properly broken. This significantly increases manufacturing efficiency since the level of light reflected from the blind crack advantageously provides an indication as to whether the brittle substrate material can be properly broken. Hsieh et al. fails to check the formation state of any

blind crack. Hsieh et al. only discloses that the workpiece is scribed concentrically on the top surface and the bottom surface and is then broken to create a magnetic disk. However, Hsieh et al. fails to direct the person of ordinary skill in the art towards the blind crack state formation checking features of the claimed combination. As such, Hsieh et al. takes a different approach and fails to disclose a scribing device that determines the formation state of a blind crack of a brittle substrate material as claimed. Accordingly, Applicant respectfully requests that the Examiner favorably consider claim 15 as now presented.

Claims 1 and 9 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Fanning (US 4,229,865) in view of Hoekstra et al. (US 6,211,488).

Fanning discloses a machine for laser scribing and winding metallized film capacitor blanks. A pair of thin dielectric films, each completely metallized on one side, are advanced over a pair of drums of a machine while the films are laser scribed and slit to form two sets of film strips each of which has a laser scribed capacitor plate formed thereon. The film strips emanating from the drums pass through a number of tension responsive devices and are wound on one of a pair of successively positioned takeup split mandrels. A compensating mechanism is included in one of the drum drives to vary the speed of the drums to compensate for the difference in diameters of the wound convolutions of one set of film strips with respect to the other set so that a succession of capacitor blanks are tightly wound with consistent geometric size and capacitance value.

Hoekstra et al. discloses a substrate 4 mounted on a table 10 below a splitting device 20. The substrate 4 is initially scribed, either by a mechanical device or a laser, to initiate a

mircocrack. A scribe beam is applied onto the substrate at the microcrack in the direction that the substrate will be cut. A coolant stream is located at or adjacent to the trailing end of the scribe beam. The temperature differential between the heat affected zone of the substrate and the coolant stream propagates the initiated microcrack along the substrate. Two breaking laser beams, each laterally displaced from the microcrack on opposite sides, immediately follow the coolant stream. The breaking beams create controlled tensile forces sufficient to extend the crack to the bottom surface of the substrate, thereby dividing the substrate along the path of the microcrack. The beams are formed by an arrangement of lasers and mirrors and lenses. A movable mirror selectively diverts a beam to form either the preheat beam or one or more of the break and scribe beams.

Fanning and Hoekstra et al. as a whole fail to teach or suggest the combination of emitting light from a light source that is split by a polarization beam splitter and reflected off of a blind crack in a brittle material substrate. According to the present invention, the amount of light received via the light reception unit is used by a determination unit to determine whether the amount of light is within predetermined thresholds. Fanning and Hoekstra et al. merely disclose devices for scribing a substrate. The references as a whole do not direct the person of ordinary skill in the art toward determining a state of the formation of a blind crack in a brittle substrate material. Fanning only discloses a machine for laser scribing and making a capacitor wherein the light source of the device is separated by half mirrors such that the light from the light source is projected on to a pair of metallized films for scribing. However, Fanning is void of any suggestion that the light from the light source is split by a polarizing beam splitter and

is received by a light reception unit and a determination unit to determine the status of a blind crack in the substrate as claimed.

Similar to Fanning, Hoekstra et al. only discloses forming a microcrack on a non-metallic substrate and separating the substrate, but Hoekstra et al. does not disclose how to use a determination unit in combination with a polarization beam splitter and a light reception unit to check the formation of the microcrack to determine whether the substrate can be properly broken. In contrast to Fanning and Hoekstra et al., the determination unit of the present invention determines whether a level of light, which has been reflected off of the blind crack, that is received by the light reception element is within predetermined thresholds. This allows a determination of whether the substrate can be broken properly based on the shape state of the blind crack. This advantageously increases manufacturing efficiency since the present invention ensures that only substrates with a proper blind crack formation are broken. Fanning and Hoekstra et al. fail to disclose such advantages since the references as a whole do not direct the person of ordinary skill in the art toward checking the formation of a blind crack using a light reception unit, a polarizing beam splitter and a determination unit as claimed. In fact, Hoekstra et al. and Fanning do not disclose a light reception unit, a determination unit or a polarizing beam splitter as claimed. As such, the prior art as a whole do not teach each feature of the claimed combination. Accordingly, Applicant respectfully requests that the Examiner favorably consider claims 1 and 9 as now presented.

Favorable action on the merits is requested.

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